NORTH AMERICAN FROG BLADDER FLUKES

By W. W. Cort*

The bladder fluke of the frog was first reported in Europe by Loschge (1785), and fifteen years later was given the name *Distomum cygnoides* by Zeder (1800). But not until Looss (1894) published his classic work on the distomes of European fish and frogs, did it receive an adequate description.

Leidy (1851: 207) was the first to notice bladder flukes in American frogs, but his description is too brief and superficial to make a precise diagnosis of his forms possible. The first detailed description of these flukes from this continent was Bensley's account (1897) of two varieties of *Distomum cygnoides* from Canada. From material also collected in Canada Stafford (1902) later reported Bensley's two varieties and described also three new species. As far as I can find out, the literature contains no further mention of frog bladder flukes from North America.

The evolution of the nomenclature of this group is very interesting, and gives a typical illustration of the advance during the last decade in the knowledge of the structure of distomes. Braun (1899) was among the first to feel that the old genus *Distomum* was an unnatural group. He recognized the similarity in structure between the bladder flukes found in different cold blooded vertebrates, and suggested that *Distomum folium, Distomum cygnoides, Distomum cymbiforme,* and *Distomum patellare* be grouped together into the new genus *Phyllodistomum* with *Distomum folium* as the type species. Looss (1899) published the same year the first of his papers on the division of the genus *Distomum*. He further split up Braun's group, and for the distomes from the urinary bladder of the frog established the new genus *Gorgodera* (1899: 695). The old form *Distomum cygnoides* was made the type species and Bensley's American varieties were included in it as separate species under the

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names *Gorgodera amplicava* and *Gorgodera simplex*. In his earlier work Looss (1894) had mentioned that the frog bladder fluke described by Olsson as *Distomum vitellilobum* had only two testes instead of nine as in *Distomum cygnoides*, but he considered it to be a young form of the latter species. The discovery that *Gorgodera simplex* had only two testes, however, caused him to include in his diagnosis of *Gorgodera* forms with both two and nine testes. Stafford (1902) accepted Looss' new genus and named his three new species *Gorgodera translucida*, *Gorgodera opaca*, and *Gorgodera attenuata*. He noted that this genus should be divided into two groups, one containing forms with two testes and the other with nine, but he made no attempt to separate them into distinct genera. In the same year Looss (1902: 851) divided the genus *Gorgodera*, and established for the species with two testes the genus *Gorgoderina*. Later Stafford (1905: 687) accepted Looss' grouping and renamed his species of 1902 accordingly.

Stafford's species are very poorly described and in some of them the most essential points for comparison are omitted entirely. The differences which he noted between *Gorgoderina simplex* and *Gorgoderina opaca* are so slight that I am forced to doubt their specific distinctness. He based his description of *Gorgoderina opaca* on three specimens, which he found with a large number of *Gorgoderina translucida* in toads. After comparing his description of *Gorgoderina opaca* with the two descriptions and a specimen of *Gorgoderina simplex*, the only two points of difference which hold good are the greater width and bluntness of the posterior body region in the former species, and the difference in hosts. The first difference is probably due to a more contracted condition, and since in this group there seems to be no very definite specificity of hosts the second difference loses its value. None of Stafford's type material could be obtained. Considering these facts I feel justified in calling *Gorgoderina opaca* a synonym of *Gorgoderina simplex*.

Gorgoderina translucida differs from all the other species of this genus in the broadness and thinness of its posterior body region. Osborn (1903) notes its similarity to *Phyllodistomum americanum* from the salamander and after comparison of specimens of the two species states that he considers them to be in the same genus. The structural differences between the genus *Phyllodistomum* from the urinary bladder of fish and *Gorgoderina* from frogs and toads is not great and depends largely on differences in body shape, the members of the former genus being flat and spatula-shaped and of the latter thicker and more cylindrical. *Gorgoderina translucida* and *Phyllodistomum americanum* in both hosts and shape seem almost to constitute a transition between the two genera. Another observation along this same line is that of Ssinitzin (1905) who, after comparing *Gorgoderina vitellilobum* and *Phyllodistomum folium*, considered their structure to be so similar, that he decided that they belonged to the same genus. Therefore he put *Phyllodistomum folium* which is the type species of its genus into the genus *Gorgoderina*. I feel that at this time I have not sufficient data to pass judgment on the relationship of these two genera.

The European members of these genera are well known and their whole life histories have been thoroughly worked out. The American forms on the other hand are very slightly known, having been reported but few times and very inadequately described. As already noted but three authors have reported frog bladder flukes from North America.

Leidy (1851:207 & 1856:44) reported bladder flukes which he called *Distomum cygnoides* from *Rana pipiens, Rana palustris, Rana halecina, Salamandra maculosa, Salamandra rubra,* and *Salamandra salmonea*.

Bensley (1897) described *Distomum cygnoides* var. A and B, forms which were later called *Gorgodera amplicava* and *Gorgoderina simplex* from *Rana clamitans, Rana virescens*, and *Rana catesbina* from Toronto, Canada.

Stafford (1902) also from Toronto, Canada, described *Gorgoderina translucida*, from *Bufo lentiginosus* and *Rana virescens, Gorgoderina opaca* from *Bufo lentiginosus, Gorgoderina simplex* from *Rana catesbina, Gorgoderina attenuata* from *Rana virescens* and *Rana catesbiana*, and *Gorgodera amplicava* from *Rana catesbiana*.

I have at hand for the present study *Gorgoderina attenuata* from *Rana catesbiana*, Rice Lake, Ontario, from *Rana pipiens*, Urbana, Illinois, from *Rana pipiens*, Bemidji, Minnesota, and from *Rana pipiens*, North Judson, Indiana; further *Gorgodera amplicava* and *Gorgoderina simplex* from *Rana catesbiana*, Rice Lake, Ontario; and finally a new species of *Gorgodera* from *Rana virescens*, Urbana, Illinois, and from *Rana pipiens*, Bemidji, Minnesota.

From a study of the above material I am able to supplement Stafford's short description of *Gorgoderina attenuata* and add the description of a new species in the genus *Gorgodera*.

Gorgoderina attenuata Stafford 1902

During the fall of 1910 while examining for parasites a number of leopard frogs (*Rana pipiens*) I found in the urinary bladder of nine hosts thirty-seven specimens of *Gorgodera attenuata* Stafford. The heaviest infection in a single frog was nine. In the following spring Dr. Henry B. Ward kindly turned over to me a number of individuals of the same species collected by A. J. Huntsman from bull-frogs (*Rana catesbiana*) at Rice Lake, Ontario, Canada. These Canadian forms were a little smaller and more attenuated than those from *Rana pipiens*. There can be no doubt in my estimation that these two lots are both *Gorgoderina attenuata*. The size and ratio of the suckers, the shape of the body and size of the egg all correspond. The specimens from the bull-frog are a little less crowded with eggs and are probably a little younger than the other lot. This species is easily recognized on account of the extreme attenuation of the posterior region of the body, and the large size of the acetabulum as compared with the oral sucker (Fig. 7).

On account of the great activity of the worms only the general body relations could be made out in the living material. With the acetabulum firmly attached to the wall of the bladder, the posterior end would often stretch out to two or three times its normal length, become very slender and lash violently from side to side. In no other species of bladder flukes which have been examined alive has this activity been so pronounced. The total length of the living worms was about ten or twelve times their width, and the ventral sucker which was like a large bowl attached at its base, divided the animal into two distinct regions. The anterior region was cylindrical and narrow, comprising about one-third to one-fourth the length of the animal, and the posterior region, which was three-fourths as thick as wide, ended in a rather sharp point.

Sixteen of these specimens, when preserved in alcohol, varied in length from 3.3 mm. to 7.2 mm., while the Canadian material ranged from 3.5 mm. to 4.8 mm. The width depends somewhat on the state of contraction, varying from about 0.35 mm. to 0.56 mm. Measurements of cross sections of three different worms at the region of the anterior testis gave 0.46 mm. in width by 0.35 mm. in thickness, 0.56 mm. in width by 0.46 mm. in thickness, and 0.54 mm. in width by 0.46 mm. in thickness.

The ratio in size of the suckers (*os, vs,* Fig. 7) in *Gorgoderina attenuata* offers an important point in specific diagnosis, and separates it from all the other American species of this genus. The oral sucker in sixteen specimens ranged from 0.26 mm. to 0.33 mm. in diameter, and the acetabulum from 0.6 mm. to 0.82 mm., always having a width noticibly greater than the width of the body. The ratio of the suckers varied in different individuals from 1 :2.1 up to 1 :3 with an average ratio of 1 :2.5. Stafford notes the ratio in *Gorgoderina translucida* as 1 :1.5 to 1 :1.75 and in *Gorgoderina simplex* as 1 :1.3 up to 1 :1.5. As noted by this author in these two species, and observed by me in *Gorgoderina simplex,* the edges of the acetabulum do not extend beyond the sides of the body.

The digestive system offers few points of importance in specific diagnosis. The mouth opens ventrally thru the oral sucker into a narrow esophagus about 0.4 mm long. The intestinal ceca are wide apart and close to the lateral margins in the region of the body occupied by the reproductive organs, but back of the posterior testis they approach each other and terminate almost in contact not far from the posterior extremity of the animal.

As in other trematodes the anatomy of the reproductive system offers the clearest specific differences, and will be considered in some detail. Just back of the acetabulum are the paired vitelline glands (*v*, Fig. 7), which are compact organs, lobed but not divided into follicles, and connected by a transverse duct. The ovary (*o*, Fig. 7), is a small round or oval structure close behind the vitellaria and to one side of the body. In seven out of thirteen specimens the ovary was on the right side, the anterior testis to the left and the posterior testis on the same side as the ovary, and in the other six this order was reversed. This arrangement seems to indicate a condition of sexual amphitypy in this species. In a specimen 5.2 mm. in length, the ovary measured 0.32 mm. in length by 0.24 mm. in width. It is wider than thick and lies near the ventral surface. In a cross section which measured 0.31 mm. in width by 0.33 mm. in thickness, the ovary had a width of 0.22 mm. and a thickness of 0.20 mm. (Fig. 4). The ratio of thickness to width is greater than in most trematodes, but less in the next species to be described.

The testes are rather large, slightly elongated structures, lying the one slightly behind the other on opposite sides of the body, the anterior being just behind and on the opposite side from the ovary (*t*, Fig. 7). They have a greater thickness than width and lie toward the dorsal surface. In the mount for which the ovary was measured the anterior testis had a length of 0.78 mm. and a width of 0.30 mm.; and the posterior testis was 0.93 mm. in length by 0.32 mm. in width. In a cross section 0.47 mm. in width by 0.44 mm. in thickness, the anterior testis measured 0.20 mm. in width by 0.26 mm. in thickness. From the anterior ends of the testes the vasa efferentia pass forward. They run close along the dorsal body wall and unite in front of the vitellaria to form the vas deferens. Just anterior to the attachment of the acetabulum, the vas deferens enlarges into the seminal vesicle, a large pyriform sac filled with sperms. From the dosal margin of the anterior end of this organ, the ductus ejaculatorius goes directly ventrad to the genital pore, having clustered around the middle of its course the prostate glands, and being of about uniform caliber thruout its length (*p*, Fig. 5).

The connections of the female reproductive system of *Gorgoderina attenuata* are toward the dorsal surface. The oviduct originates from the middle of the dorsal surface of the ovary, and widens almost immediately into the fertilization space. It soon narrows again and gives off Laurer's canal before entering the region surrounded by the unicellular gland cells of the so-called "shell gland" (Fig. 13). Since Goldschmidt (1909) has conclusively shown that this structure has nothing to do with the production of shell material, I shall follow his lead in discarding the name of shell gland, and call it Mehlis' gland after its discoverer. Within Mehlis' gland and the oviduct becomes thicker walled and changes to the ootpye, which receives the short median duct from the yolk glands.

The beginning of the uterus passes forward, curves over between the yolk glands, and is lost in the mass of coils which fill the posterior body region. The coils and folds of the uterus of *Gorgoderina attenuata* are so complicaed that it is impossible to distinguish any definite arrangement. In fact they seem to fill all the available space in the posterior end and this whole region is so crowded with eggs that all the organs are more or less obscured. In front of the vitellaria the uterus makes several voluminous transverse folds, and then passes forward along the mid line of the body to the genital pore. The last part is modified into a short metraterm (*mt*, Fig. 5), which has slightly thicker walls than the rest of the uterus.

Eggs from living individuals of this species taken from near the genital pore, measured about 0.053 mm. by 0.034 mm., while eggs from the same region of alcoholic specimens were only 0.032 mm. by 0.022 mm. This shows the danger in the study of species having thin shelled eggs of comparing the measurements of eggs from alcoholic material with those from living animals. In the largest eggs fully developed miracidia could be seen turning around within the shell. Such eggs when placed in ordinary tap or distilled water after ten or fifteen minutes began to pop open and liberate the miracidia. In fact when the worm was broken up in water on a slide, and studied under high power, in a short time great numbers of the minute larvae swarmed across the field of vision. They were cylindrical in shape, pointed at one end, and swam with a rapid whirling motion. Gradually they became distorted and went to pieces, none living more than a few minutes. We can judge from the above observation that in a few minutes after the eggs pass from the salinity of the frog's bladder into the surrounding water the change in osmotic pressure liberates the miracidia, which start in their search for a snail host. Whether they can live for more than a few minutes it would take further observations and experiments to decide. It may be of value to note in this connection that for the demonstration of the miracidia stage of trematodes to classes, there is probably no material more easily obtained and better for study than the larvae which are liberated from the eggs of the frog bladder flukes. As in all the forms of this group I have ever seen, the eggs are in an advanced stage of development, I am confident that this experiment would work with any of these species.

Gorgodera minima nov. sp.

In the fall of 1910 I found in the bladder of a large specimen of the bull frog (*Rana catesbiana*) fifty very small trematodes (Fig. 1) which differed so greatly from all the known species that I have considered them to belong to a new species of the genus *Gorgodera*. In October of the following year, I obtained some further specimens (Fig. 2) of the same species, which had been collected from the leopard frog (*Rana pipiens*) at Bemidji, Minnesota, by Herman Douthitt. In the bull frog the wall of the bladder was thickly crowded with the minute worms, which were so tightly attached by the acetabulum, that it was necessary to tear the tissue of the bladder to shreds before they would loosen their hold. When killed in corrosive acetic by the shaking method of Looss the worms became somewhat contracted, and showed a tendency to bend backward at the acetabulum forming an angle of almost 90 degrees.

These distomes vary in length from 0.9 mm. to 1.58 mm. The smallest individuals have a considerable number of eggs in the posterior end, while the largest have the uterus crowded thruout its length. In a specimen measuring 1.58 mm. the internal organs were almost entirely obscured, and the posterior end assumed the character of a distended egg sac. The extremely small size of this species is very striking. In the genus *Gorgodera* the smallest previously described form is between 3 mm. and 5 mm. in length, and the others are all over 7 mm. I shall call this new species *Gorgodera minima*.

The ventral sucker divides the worm into two nearly equal parts (*vs*, Figs. 1 & 2), the anterior region being somewhat narrower and shorter than the posterior. Both regions are almost cylindrical, the posterior tapering slightly to a blunt point. In an individual crowded with eggs, a cross section thru the middle of the anterior end measured 0.27 mm. in width by 0.26 mm. in thickness (Fig. 8), one at the region of the ovary 0.37 mm. in width by 0.31 mm. in thickness (Fig. 10), and one thru the posterior testis 0.31 mm. by 0.27 mm. (Fig. 11).

The acetabulum in *Gorgodera minima* is very large as compared with the size of the worm and appears much as in the proceeding species. It is circular from ventral view, the average diameter for ten specimens being 0.39 mm. The oral sucker has a diameter of about 0.20 mm., making the ratio of the two a little less than 2:1.

The mouth appears as a slit-like transverse aperture toward the anterior part of the oral sucker (*m*, Fig. 1), opening ventrally and about one-fifth or one-sixth the width of the sucker. The esophagus is short and narrow, about 0.017 mm. in width and 0.12 mm. in length. The intestinal ceca are about 0.06 mm. in width and at the beginning of their course are dorsal, and wide apart to give room for the greatly developed vesicula seminalis. In the narrow portion of the animal just dorsal to the acetabulum the ceca come closer together, and just posterior to this structure they spread very widely to pass to the outside of the reproductive organs, which fill almost the entire width of the animal at this region. They continue backward outside of the reproductive organs almost to the posterior extremity of the body. They may be next to the outside wall or portions of the uterus may run to the outside of them.

The reproductive system of *Gorgodera minima* is very similar to that of *Gorgodera amplicava* and *Gorgodera cygnoides*. The chief differences are in the relative size of the parts and in the distances between them, which to some extent at least are determined by the size and shape of the animal. The testes are nine in number, five on the same side as the ovary and four on the opposite side (Fig. 1). They are in shape rectangular prisms crowded very closely together. All the testes seem to be about the same size and the average measurements for a single testis are 0.05 mm. longitudinally, 0.08 mm. laterally, and 0.24 mm. dorsoventrally (Fig. 11). This peculiar shape is an important distinguishing feature of the species. One might compare the testes to two series of cigar boxes attached by strings thru their centers and arranged four on one side and five on the other, with the strings from each lateral series connecting further forward. The testes themselves are somewhat irregular in outline, slightly lobed, and connected by a series of short tubules. From the middle of the anterior surfaces of the anterior testes on each side run forward the vasa efferentia. These tubules unite in front of the ovary and the yolk glands into the vas deferens, which passes dorsal to the acetabulum into the vesicula seminalis, a large pyriform sac following a slightly spiral course and filled with sperms (*s*, Fig. 1). In a worm 0.9 mm. long this organ measured 0.14 mm. in length, and in a cross section of another worm, 0.30 mm. in width and 0.26 mm. in thickness, it measured 0.99 mm. in width by 0.11 mm. in thickness (Fig. 8). These measurements are of course somewhat modified by the state of contraction, but are given to show the relatively large size of the seminal vesicle in this species. From the anterior end of the seminal vesicle the ejaculatory duct curves down, and opens ventrally at the common gential pore. This duct is quite long in *Gorgodera minima* and widens out before opening into the pore into a small chamber lined with rather tall epithelial cells among which are heavily staining club-shaped cells, which appear to be glandular. Around the first part of the ejaculatory duct are grouped the prostate glands (*p*, Fig. 6).

The vitellaria in *Gorgodera minima* are composed of two groups of nine to eleven follicles each, lying one to each side of the animal just back of the acetabulum. They are connected by a transverse vitelline duct which opens into a common vitelline reservoir. On the left side immediately behind these glands, and often overlapping them ventrally is the ovary which is irregular and slightly lobed, and has a thickness almost equal to the thickness of the worm (Fig. 4). In a cross section thru the middle of the ovary, 0.28 mm. wide by 0.26 mm. thick, this organ had a width of 0.12 mm. and a thickness of 0.20 mm. (Fig. 10). It lies toward the ventral surface and is widest toward this side. In a frontal section 1.1 mm. long by 0.28 mm. wide, the ovary measured 0.1 mm. with the length of the animal and 0.15 mm. with its width. None of my specimens showed sexual amphitypy, in all of them the ovary being to the left. The oviduct leaves the dorsal surface of the ovary, widens immediately into the fertilization space, and narrowing again, passes forward still near the dorsal surface to change into the ootype within Mehlis' gland. This is a small group of unicellular gland cells, which lie dorsally between the groups of follicles of the vitelline glands. Within Mehlis' gland the median duct from the vitellaria opens into the ootype. Laurer's canal opens from the oviduct about half way between the fertilization space and the ootype. From its junction with the oviduct, this duct which is very narrow, passes ventrad and then doubles back to open on the dorsal surface back of the ovary (Fig.

3). As with the testes the longest axes of the vitellaria and ovary are with the thickness of the animal.

From the ootype the uterus goes to the side opposite the ovary and folds down the region outside of the testes to the posterior extremity of the body, where it fill with its coils the region back of the intestinal ceca and testes. From this region it winds forward on the opposite side, filling not only the region between the groups of testes, but also all the available space between the testes and body wall and even between the individual testes. In front of the testes it emerges from this mass of coils, to pass to the ventral side of the ovary, over the acetabulum and forward ventral to the vesicula seminalis to the genital pore (Fig. 4). In such a uterus as the one described above the whole course is distended with eggs. In younger worms where fewer eggs are present there is less complication. In general the course of the uterus is down the side opposite the ovary and up the other side to the gen'tal pore filling all the available space between the organs.

The eggs in *Gorgodera minima* increase in size as they develop in the uterus from the ootype to the gential pore. In preserved specimens the eggs average in size at the ootype about 0.021 mm. by 0.014 mm., in the coils of the posterior end 0.024 mm. by 0.017 mm., and just behind the genital pore, where they contain fully developed embryos, 0.032 mm. by 0.022 mm. Looss (1894:63) notes similar differences in size in the eggs of *Distomum cygnoides*. I have no measurements of eggs from living animals. As noted by Stafford (1902:418) in *Gorgoderina simplex* and observed by me in *Gorgoderina attenuata* eggs of the type found in this group shrink considerably after preservation in alcohol. Therefore in this species also comparisons should not be made between living and preserved eggs.

Gorgodera minima is the second American species of the genus *Gorgodera*, the other species being *Gorgodera amplicava*, described by Bensley (1897). The most striking differences between these two species are in the size and shape of the animals, the ratio in size of the suckers, and in the shape and relations of the reproductive organs. *Gorgodera minima* is a very small worm, 1 to 2 mm. in length, with the anterior and the posterior regions of almost equal size and almost cylindrical, while *Gorgodera amplicava* is much longer, 3 to 5 mm., considerably wider, with the posterior body flattened and pointed much like the blade of a two edged knife. The anterior region in this worm is also very small in proportion to the posterior, being about one-third as long and not one-fourth as wide, altho thicker. In *Gorgodera amplicava* the acetabulum is not only twice as large as in *Gorgodera minima*, but is from two and one-half to three times as large as the oral sucker, while in the later species the ratio is less than two to one. The great relative thickness of the testes and ovary in *Gorgodera minima* is another feature which differentiates it from *Gorgodera amplicava*. The seminal vesicle is relatively much larger in the former than in the latter species. The European species of *Gorgodera* are larger than the American, all being over 7 mm. in length. *Gorgodera minima* is by far the smallest representative of the genus *Gorgodera* yet reported.

In order to facilitate comparison there is given here a list of the genera and species of frog bladder flukes, a table of the hosts and localities of the forms reported from North America, and a key for the identification of North American species.

Of frog bladder flukes there have been described two genera and ten species:

Gorgodera	Gorgoderina
Gorgodera Pagenestecheri Ssinitzin	*Gorgoderina simplex* Looss
Gorgodera Loossi Ssinitzin	Syn. *Gorgoderina opaca* Stafford
Gorgodera Varsoviensis Ssinitzin	*Gorgoderina vitellilobum* Olsson
Gorgodera Amplicava Looss	*Gorgoderina translucida* Stafford
Gorgodera minima Cort	*Gorgoderina attenuata* Stafford.

The following table includes all the reports which could be found of frog bladder flukes from North America.

Frog Bladder Flukes Reported from North America

Date	Author	Name used	Present name	Hosts	Locality
1851	Leidy.	Distomum cygnoides.	(?)	Rana pipiens, Rana palustris, Rana halecina, Salamandra maculosa, Salamandra rubra, Salamandra salmonea.	(?)
1897	Bensley.	Distomum cygnoides, var. A.	Gorgodera amplicava.	Rana clamitans.	
				Rana virescens.	Toronto, Canada.
		Distomum cygnoides, var. B.	Gorgoderina simplex.	Rana catesbiana.	
1902	Stafford.	Gorgodera translucida.	Gorgoderina translucida.	Bufo lentiginosus. Rana virescens.	Toronto, Canada.
		Gorgodera simplex.	Gorgoderina simplex.	Rana catesbiana	Toronto, Canada.
		Gorgodera opaca.	Gorgoderina simplex.	Bufo lentiginosus.	Toronto, Canada.
		Gorgodera attenuata.	Gorgoderina attenuata.	Rana virescens. Rana catesbiana	Toronto, Canada. Toronto, Canada.
		Gorgodera amplicava.	Gorgodera amplicava.	Rana catesbiana	Toronto, Canada.
1912	Cort.		Gorgoderina simplex.	Rana catesbiana	Rice Lake Ontario, Can.
			Gorgodera amplicava.	Rana catesbiana	Rice Lake Ontario, Can.
			Gorgoderina attenuata.	Rana catesbiana	Rice Lake Ontario, Can.
			Gorgoderina attenuata.	Rana pipiens.	Urbana, Ill.
			Gorgoderina attenuata.	Rana pipiens.	North Judson, Ind.
			Gorgoderina attenuata.	Rana pipiens.	Bemidji, Minn.
			Gorgodera minima.	Rana pipiens.	Bemidji, Minn.
			Gorgodera minima.	Rana catesbiana	Urbana, Ill.

The following key may be of value to American workers for the identification of any specimens of this group which may fall into their hands.

Key to North American Frog Bladder Flukes

1(4) Bladder flukes with nine testes.
Genus *Gorgodera* Looss 1899...2

2(3) Length 3-5 mm.; posterior body region flat and transparent; acetabulum 2.5 to 3 times the size of oral sucker.
Gorgodera amplicava Looss 1899

3(2) Length 1 to 2 mm.; posterior body region opaque and almost cylindrical; acetabulum 1.6-2 times oral sucker.
Gorgodera minima nov. sp.

4(1) Bladder flukes with two testes.
Genus *Gorgoderina* Looss 1902...5

5(6) Posterior body region broad flat and transparent; thickness about one-third the width.
Gorgoderina translucida Stafford 1902

6(5) Posterior body region opaque and thick; thickness one-half or more than one-half width.......................................7

7(8) Acetabulum 1.3 to 1.5 times oral sucker.
Gorgoderina simplex Stafford 1902
Syn. *Gorgoderina opaca* Stafford 1902

8(7) Acetabulum more than 2 times oral sucker.
Gorgodera attenuata Stafford 1902

Osborn's *Phyllodistomum americanum* from a urodele should be mentioned in this connection. It is possible that this form may be found in the frog. Frog bladder flukes which do not come under this key may perhaps belong to one or the other of the European species of these genera not yet reported in this country.

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Abbreviations Used in Plates

e, Esophagus
f, Fertilization space
g, Genital pore
i, Intestine
l, Laurers' canal
m, Mouth
mg, Mehlis' gland
mt, Metraterm
os, Oral sucker
o, Ovary
od, Oviduct
p, Prostate glands
s, Seminal vesicle
t, Testes
u, Uterus
v, Vitelline gland
vd, Vas deferens
ve, Vas efferens
vs, Ventral sucker.

Explanation of Plates

All drawings were made with a camera lucida.

Plate XV

Fig. 1. *Gorgodera minima* from Urbana, Illinois, seen from ventral surface. Young specimen with but few eggs in the uterus. ×108.

Fig. 2. *Gorgodera minima* from Bemidji, Minnesota, seen from dorsal surface. About the same age and size as figure 1 but slightly less magnified. ×88.

Fig. 3. Reconstruction from frontal sections of the region just back of the acetabulum in *Gorgodera minima*, showing the organs and their connections in the female reproductive system, as seen from dorsal surface. ×180.

Fig. 4. Cross section of body at level of ovary in *Gorgoderina attenuata*. ×180.

Fig. 5. Reconstruction from sagittal sections of *Gorgoderina attenuata*, showing the genital pore and the ends of the ducts of the reproductive systems. ×300.

Fig. 6. Reconstruction from sagittal sections of *Gorgodera minima*, showing the genital pore and the ends of the ducts of the reproductive systems. ×300.

Fig. 7. *Gorgoderina attenuata* seen from ventral surface. ×36.

Plate XVI

Fig. 8-12. A series of cross sections from a specimen of *Gorgodera minima*, showing the structure of important organs at different levels. ×180.

Fig. 8. Section thru the seminal vesicle at about the level of the guide line to *s* in figure 1.

Fig. 9. Section thru the acetabulum at about the level of the guide line to *vs* in figure 1.

Fig. 10. Section thru the ovary at about the level of the guide line to *o* in figure 1.

Fig. 11. Section thru the testicular region at about the level of the middle guide line from *t* in figure 1.

Fig. 12. Section thru the post-testicular region at about the level of the guide line to *u* in figure 1.

Fig. 13. Reconstruction from frontal sections of the region just back of the acetabulum in *Gorgoderina attenuata*, showing the organs and their connections in the female reproductive system as seen from the dorsal surface. ×180.